Table D10. Emission Rates by Activity (2011)

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,680.4
TS&G - Barge - Main	6.6	0.4	1.1	3.5	672.1
TS&G - Barge - Gen - Aux	1.5	0.1	0.3	1.1	147.3
Total	***28.0***	***1.3***	***3.3***	***10.3***	***2,499.8***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,680.4
TS&G - Barge - Gen - Aux	1.5	0.1	0.3	1.1	147.3
Total	***21.3***	***0.9***	***2.2***	***6.7***	***1,827.6***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	6.6	0.4	1.1	3.5	672.1
TS&G - Barge - Gen - Aux	1.5	0.1	0.3	1.1	147.3
Total	***8.1***	***0.5***	***1.4***	***4.6***	***819.4***
Hanson DS-10 - Mining					
American River Tug	13.1	0.5	1.3	3.7	1,105.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	739.4
DS-10 - Barge (Generator)	2.1	0.1	0.4	1.5	208.4
Total	***23.9***	***1.0***	***2.5***	***7.7***	***2,052.9***
Hanson DS-10 - Cruising					
American River Tug	13.1	0.5	1.3	3.7	1,105.2
DS-10 - Barge (Generator)	2.1	0.1	0.4	1.5	208.4
Total	***15.1***	***0.7***	***1.7***	***5.3***	***1,313.6***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	739.4
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	244.6
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	244.6
Barge - Gen - Aux	2.1	0.1	0.4	1.5	208.4
Total	***16.6***	***0.7***	***1.9***	***6.3***	***1,436.9***
Jerico Barge - Mining					
Jerico Barge - Generator	0.7	0.0	0.1	0.3	55.0
Jerico Barge - Monitor	1.5	0.1	0.2	0.6	127.8
Total	***2.2***	***0.1***	***0.3***	***0.9***	***182.9***
Jerico Barge - Cruising					
Jerico Tug - Main	8.1	0.3	0.8	2.3	685.1
Jerico Barge - Generator	0.7	0.0	0.1	0.3	55.0
Total	***8.7***	***0.4***	***0.9***	***2.6***	***740.1***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	108.4
Total	***0.9***	***0.0***	***0.1***	***0.7***	***108.4***

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TRC

Table D10A. Emission Rates by Activity (2011) - Corrected

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Main	5.6	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***26.6***	***1.3***	***3.3***	***10.3***	***2,423.0***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***21.0***	***0.9***	***2.2***	***6.7***	***1,771.5***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	5.6	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***6.7***	***0.5***	***1.4***	***4.6***	***794.3***
Hanson DS-10 - Mining					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	716.7
DS-10 - Barge (Generator)	1.7	0.1	0.4	1.5	202.0
Total	***23.5***	***1.0***	***2.5***	***7.7***	***1,989.9***
Hanson DS-10 - Cruising					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Generator)	1.7	0.1	0.4	1.5	202.0
Total	***14.7***	***0.7***	***1.7***	***5.3***	***1,273.3***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	716.7
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	237.0
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	237.0
Barge - Gen - Aux	1.7	0.1	0.4	1.5	202.0
Total	***16.2***	***0.7***	***1.9***	***6.3***	***1,392.8***
Jerico Barge - Mining					
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Jerico Barge - Monitor	1.5	0.1	0.2	0.6	123.9
Total	***1.9***	***0.1***	***0.3***	***0.9***	***177.2***
Jerico Barge - Cruising					
Jerico Tug - Main	8.1	0.3	0.8	2.3	664.0
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Total	***8.5***	***0.4***	***0.9***	***2.6***	***717.4***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	105.1
Total	***0.9***	***0.0***	***0.1***	***0.7***	***105.1***

10-61 cont.

TRC

Table D11. Annual Emissions (2011)

Barge	Mining Events	Activity	Hours	Emission Rates (lb/hr)					Annual Emissions (tons per year)				
				NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
		Cruising	2	21.3	0.9	2.2	6.7	1,827.6	8.5	0.4	0.9	2.7	727.4
		Mining	5.5	28.0	1.3	3.3	10.3	2,499.8	30.6	1.4	3.6	11.2	2,736.0
Hanson (TS&G 230)	398	Unloading	4	8.1	0.5	1.4	4.6	819.4	6.5	0.4	1.1	3.7	652.3
		Cruising	2	15.1	0.7	1.7	5.3	1,313.6	6.0	0.3	0.7	2.1	522.8
		Mining	5.5	23.9	1.0	2.5	7.7	2,052.9	26.1	1.1	2.8	8.5	2,246.9
Hanson (DS-10)	398	Unloading	4	16.6	0.7	1.9	6.3	1,436.9	13.2	0.6	1.5	5.0	1,143.8
		Cruising	2	21.3	0.9	2.2	6.7	1,827.6	0.8	0.0	0.1	0.3	69.5
Suisun Associates (TS&G		Mining	5.5	28.0	1.3	3.3	10.3	2,499.8	2.9	0.1	0.3	1.1	261.2
230)	38	Unloading	4	8.1	0.5	1.4	4.6	819.4	0.6	0.0	0.1	0.4	62.3
		Cruising	2	15.1	0.7	1.7	5.3	1,313.6	0.6	0.0	0.1	0.2	48.6
Suisun Associates (DS-		Cruising	2	23.9	1.0	2.5	7.7	2,052.9	0.9	0.0	0.1	0.3	76.0
10)	37	Cruising	2	16.6	0.7	1.9	6.3	1,436.9	0.6	0.0	0.1	0.2	53.2
		Cruising	2	8.7	0.4	0.9	2.6	740.1	0.7	0.0	0.1	0.2	55.5
Suisun Associates (Jerico		Mining	5.5	2.2	0.1	0.3	0.9	182.9	0.4	0.0	0.1	0.2	37.7
Barge)	75	Unloading	12	0.9	0.0	0.1	0.7	108.4	0.4	0.0	0.1	0.3	48.8
		Cruising	2	8.7	0.4	0.9	2.6	740.1	0.3	0.0	0.0	0.1	23.7
		Mining	5.5	2.2	0.1	0.3	0.9	182.9	0.2	0.0	0.0	0.1	16.1
Jerico	32	Unloading	12	0.9	0.0	0.1	0.7	108.4	0.2	0.0	0.0	0.1	20.8
Total Emisisons (tons per year)									**99.4**	**4.5**	**11.6**	**36.6**	**8,802.4**

10-61 cont.

Table D11A. Annual Emissions (2011) - Corrected

Barge	Mining Events	Activity	Hours	Emission Rates (lb/hr)					Annual Emissions (tons per year)				
				NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
		Cruising	2	21.0	0.9	2.2	6.7	1771.5	8.4	0.4	0.9	2.7	705.1
		Mining	5.5	26.6	1.3	3.3	10.3	2423.0	29.1	1.4	3.6	11.2	2,652.0
Hanson (TS&G 230)	398	Unloading	4	6.7	0.5	1.4	4.6	794.3	5.4	0.4	1.1	3.7	632.2
		Cruising	2	14.7	0.7	1.7	5.3	1273.3	5.9	0.3	0.7	2.1	506.8
		Mining	5.5	23.5	1.0	2.5	7.7	1989.9	25.7	1.1	2.8	8.5	2,178.0
Hanson (DS-10)	398	Unloading	4	16.2	0.7	1.9	6.3	1392.8	12.9	0.6	1.5	5.0	1,108.7
		Cruising	2	21.0	0.9	2.2	6.7	1771.5	0.8	0.0	0.1	0.3	67.3
Suisun Associates (TS&G		Mining	5.5	26.6	1.3	3.3	10.3	2423.0	2.8	0.1	0.3	1.1	253.2
230)	38	Unloading	4	6.7	0.5	1.4	4.6	794.3	0.5	0.0	0.1	0.4	60.4
		Cruising	2	14.7	0.7	1.7	5.3	1273.3	0.5	0.0	0.1	0.2	47.1
Suisun Associates (DS-		Cruising	2	23.5	1.0	2.5	7.7	1989.9	0.9	0.0	0.1	0.3	73.6
10)	37	Cruising	2	16.2	0.7	1.9	6.3	1392.8	0.6	0.0	0.1	0.2	51.5
		Cruising	2	8.5	0.4	0.9	2.6	717.4	0.6	0.0	0.1	0.2	53.8
Suisun Associates (Jerico		Mining	5.5	1.9	0.1	0.3	0.9	182.9	0.4	0.0	0.1	0.2	37.7
Barge)	75	Unloading	12	0.9	0.0	0.1	0.7	108.4	0.4	0.0	0.1	0.3	48.8
		Cruising	2	8.5	0.4	0.9	2.6	740.1	0.3	0.0	0.0	0.1	23.7
		Mining	5.5	1.9	0.1	0.3	0.9	182.9	0.2	0.0	0.0	0.1	16.1
Jerico	32	Unloading	12	0.9	0.0	0.1	0.7	108.4	0.2	0.0	0.0	0.1	20.8
Total Emisisons (tons per year)									**95.5**	**4.5**	**11.6**	**36.6**	**8,536.7**
% Reduction due to TRC corrections:									3.95%	0.00%	0.00%	0.00%	3.02%

TRC

Table D12. Emission Factors for Mining Equipment (2018)

Equipment Name	Type	Manufacture Year [a]	Horsepower [a]	Load Factor [b]	Emission Factor (g/bhp-hr) [c,d]					Emission Rate (lb/hr)				
					NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	5.8	0.29	0.68	1.97	586.3	10.9	0.5	1.3	3.7	1,105.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	5.8	0.29	0.68	1.97	586.3	16.6	0.8	1.9	5.6	1,680.4
	Barge - Main Engine	1983	1,000	0.52	5.8	0.36	0.95	3.07	586.3	6.6	0.4	1.1	3.5	672.1
	Barge - Generator (Aux)	1984	265	0.43	5.8	0.32	1.07	4.33	586.3	1.5	0.1	0.3	1.1	147.3
Hanson TS & G	Barge - Thruster (Aux)	1984	304	0.43	5.8	0.32	1.07	4.33	586.3	1.7	0.1	0.3	1.2	169.0
	Barge - Main Engine	2001	1,100	0.52	6.93	0.29	0.68	1.97	586.3	8.7	0.4	0.9	2.5	739.4
	Barge - Monitor Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	586.3	2.9	0.1	0.3	1.2	244.6
	Barge - Flood Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	586.3	2.9	0.1	0.3	1.2	244.6
Hanson DS-10	Barge - Generator (Aux)	1984	375	0.43	5.8	0.32	1.07	4.33	586.3	2.1	0.1	0.4	1.5	208.4
	Tug (2 engines)	2001	1,060	0.5	5.8	0.29	0.68	1.97	586.3	6.8	0.3	0.8	2.3	685.1
Jerico Tug	Tug (generator)	2000	64	0.31	5.8	0.46	1.18	3.59	586.3	0.3	0.0	0.1	0.2	25.6
	Barge Generator (Aux)	2004	99	0.43	5.8	0.46	1.18	3.59	586.3	0.5	0.0	0.1	0.3	55.0
Jerico Barge	Barge Pump (Aux)	2001	230	0.43	5.8	0.26	0.81	2.78	586.3	1.3	0.1	0.2	0.6	127.8
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	586.3	0.9	0.0	0.1	0.7	108.4

[a] Provided by Project Applicants

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making. Proposed Regulation for Commercial Harbor Craft.* September 2007

[c] Assumes all Hanson engines manufactured in or prior to 2003 would meet USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5.8 grams per brake-horsepower hour) by 2018

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines.

Table D12A. Emission Factors for Mining Equipment (2018) - Corrected

Equipment Name	Type	Manufacture Year [a]	Horsepower [a]	Load Factor [b]	Emission Factor (g/bhp-hr) [c,d]					Emission Rate (lb/hr)				
					NOx[2]	PM	ROG	CO	CO2[1]	NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	5.12	0.29	0.68	1.97	568.3	9.7	0.5	1.3	3.7	1,071.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	5.12	0.29	0.68	1.97	568.3	14.7	0.8	1.9	5.6	1,628.8
	Barge - Main Engine	1983	1,000	0.52	4.83	0.36	0.95	3.07	568.3	5.6	0.4	1.1	3.5	651.5
	Barge - Generator (Aux)	1984	265	0.43	4.73	0.32	1.07	4.33	568.3	1.2	0.1	0.3	1.1	142.8
Hanson TS & G	Barge - Thruster (Aux)	1984	304	0.43	4.73	0.32	1.07	4.33	568.3	1.4	0.1	0.3	1.2	163.8
	Barge - Main Engine	2001	1,100	0.52	5.12	0.29	0.68	1.97	568.3	6.5	0.4	0.9	2.5	716.7
	Barge - Monitor Pump (Aux)	2002	440	0.43	4.99	0.26	0.81	2.78	568.3	2.1	0.1	0.3	1.2	237.0
	Barge - Flood Pump (Aux)	2002	440	0.43	4.99	0.26	0.81	2.78	568.3	2.1	0.1	0.3	1.2	237.0
Hanson DS-10	Barge - Generator (Aux)	1984	375	0.43	4.73	0.32	1.07	4.33	568.3	1.7	0.1	0.4	1.5	202.0
	Tug (2 engines)	2001	1,060	0.5	5.12	0.29	0.68	1.97	568.3	6.0	0.3	0.8	2.3	664.0
Jerico Tug	Tug (generator)	2000	64	0.31	4.62	0.46	1.18	3.59	568.3	0.2	0.0	0.1	0.2	24.9
	Barge Generator (Aux)[3]	2004	99	0.43	4.62	0.46	1.18	3.59	568.3	0.4	0.0	0.1	0.3	53.3
Jerico Barge	Barge Pump (Aux)	2001	230	0.43	4.99	0.26	0.81	2.78	568.3	1.1	0.1	0.2	0.6	123.9
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	568.3	0.9	0.0	0.1	0.7	105.1

[a] Provided by Project Applicants

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making. Proposed Regulation for Commercial Harbor Craft.* September 2007

[c] Assumes all Hanson engines manufactured in or prior to 2003 would meet USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5.8 grams per brake-horsepower hour) by 2018

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines.

[1] Correction noted in TRC Comment 2. *CO2 Emission Factor Accuracy*

[2] Correction noted in TRC Comment 3. *NOx Tier II Emission Factor Accuracy*

[3] Correction noted in TRC Comment 6. *Jerico Dredge Barge Generator NOx Emission Factor*

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Table D13. Emission Rates by Activity (2018)

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	16.6	0.8	1.9	5.6	1,680.4
TS&G - Barge - Main	6.6	0.4	1.1	3.5	672.1
TS&G - Barge - Gen - Aux	1.5	0.1	0.3	1.1	147.3
Total	***24.7***	***1.3***	***3.3***	***10.3***	***2,499.8***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	16.6	0.8	1.9	5.6	1,680.4
TS&G - Barge - Gen - Aux	1.5	0.1	0.3	1.1	147.3
Total	***18.1***	***0.9***	***2.2***	***6.7***	***1,827.6***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	6.6	0.4	1.1	3.5	672.1
TS&G - Barge - Gen - Aux	1.5	0.1	0.3	1.1	147.3
Total	***8.1***	***0.5***	***1.4***	***4.6***	***819.4***
Hanson DS-10 - Mining					
American River Tug	10.9	0.5	1.3	3.7	1,105.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	739.4
DS-10 - Barge (Generator)	2.1	0.1	0.4	1.5	208.4
Total	***21.7***	***1.0***	***2.5***	***7.7***	***2,052.9***
Hanson DS-10 - Cruising					
American River Tug	10.9	0.5	1.3	3.7	1,105.2
DS-10 - Barge (Generator)	2.1	0.1	0.4	1.5	208.4
Total	***13.0***	***0.7***	***1.7***	***5.3***	***1,313.6***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	739.4
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	244.6
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	244.6
Barge - Gen - Aux	2.1	0.1	0.4	1.5	208.4
Total	***16.6***	***0.7***	***1.9***	***6.3***	***1,436.9***
Jerico Barge - Mining					
Jerico Barge - Generator	0.5	0.0	0.1	0.3	55.0
Jerico Barge - Monitor	1.3	0.1	0.2	0.6	127.8
Total	***1.8***	***0.1***	***0.3***	***0.9***	***182.9***
Jerico Barge - Cruising					
Jerico Tug - Main	6.8	0.3	0.8	2.3	685.1
Jerico Barge - Generator	0.5	0.0	0.1	0.3	55.0
Total	***7.3***	***0.4***	***0.9***	***2.6***	***740.1***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	108.4
Total	***0.9***	***0.0***	***0.1***	***0.7***	***108.4***

10-61 cont.

TRC